Sterilization and Infection control



Why Infection Control Is Important in Dentistry?

- Both patients and dental personnel can be exposed to pathogens.
- Contact with blood, oral and respiratory secretions, and contaminated equipment occurs.
- Proper procedures can prevent transmission of infections to patients and Dentist.

Objectives of infection control program

- 1. Reduce the number of available pathogenic microbes to a level where the normal resistance mechanisms of the body can prevent infection.
- 2. Break the circle of infection and eliminate cross contamination between the patients and dental personnel.
- 3. Treat every patient or instrument as a possible source of infectious disease transmission.

Diseases of concern in dental Practice

A. Bacterial infections of concern in the dental practice:

- **1. Tuberculosis**
- **2.Tonsillitis**
- **3. Syphilis.**
- **5. Legionellosis**
- **6. Tetanus**
- **7. Meningitis**

B- Viral diseases of concern in dental practice

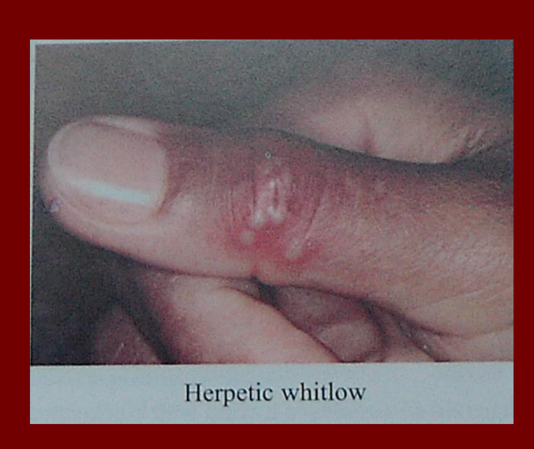
- **Hepatitis B virus (HBV) infection**
- **Hepatitis C virus (HCV) infection**
- **Human immunodeficiency virus and AIDS**
- **Herpes simplex (HSV)**
- **Varicella virus : Chickenpox**
- **Cytomegalovirus (CMV) infection**
- **Mumps.**
- Rubella (German measles)

C.Fungal Disease of concern in Dental Practice

- **Candidosis**

Diseases Transmission in the Dental Office

- Patient to Dental Team:
    1. Direct contact.
    2. Droplet infection.
    3. Indirect contact.
- Dental Team to Patient.
- Patient to Patient.
- Dental office to community.
- Community to Dental office.


Herpetic whitlow

Infection Control Precautions in the Dental Office

- **(I) Standard Precautions**:

  (1) Immunizations
  (2) Medical history
  (3) Hand washing.
  (4) Barrier techniques
    1. Protective Clothing
    2. Face Masks
    3. Eye protection
    4. Gloves

  (**5**) Instruments Sterilization and Disinfection
  (6) Cleaning and disinfecting of environmental surfaces
  (7) Dental Laboratory Asepsis
  (8) Radiographic infection control.
  (9) Dental unit waterlines
  (10) Needles stick Injury
  (11) Management of medical waste

(I) Standard Precautions

- The same infection control procedures are used for all patients.
- Assume all patients are potentially infectious.

(1) Immunizations

All dental personnel must be immunized against



- Hepatitis A, Hepatitis B.
- Tuberculosis
- Varicella (chicken box)
- Measles
- Mumps
- Rubella (German measles)
- Influenza
- Tetanus/ Diphtheria



No Vaccination For Following Diseases

- HIV or AIDS
- Hepatitis C
- Therefore, Proper infection control procedures are important to prevent transmission of any pathogens.

(2) Proper patient history

- The practitioner should identify:

the patients with infectious diseases through appropriate questions.

. Many infected persons are asymptomatic carriers and can't be identified by history, so making **standard precautions** essential for all patients.

(3)Hand Hygiene

- The most important measure to preventing disease transmission.



Hands Need to be Cleaned When

- Before and after patient treatment (before glove placement and after glove removal)
- After touching contaminated objects with bare hands
- Visibly dirty



Fingernails, Artificial Nails, & Jewelry

- Do not wear hand or nail jewelry if it makes donning gloves more difficult or compromises the fit and integrity of the glove
- Keep fingernails short with smooth, filed edges to allow thorough cleaning and to prevent glove tears
- Use of artificial fingernails is usually not recommended



Hand Hygiene Definitions

- Handwashing
  - Washing hands with plain soap and water
- Antiseptic hand-wash
  - Washing hands with water and soap or other detergents containing an antiseptic agent
- Alcohol-based handrub
  - Rubbing hands with an alcohol-containing preparation



(4)Barrier techniques

- Use of Personal Protective Equipment during treatment:

  In the following order

  1. Protective Clothing (i.e., lab coat/jacket).
  2. Face Masks.
  3. Eye protection, face shield.
  4. Gloves.



1. Protective Clothing

- Wear long-sleeved reusable or disposable gowns, clinic jackets, or lab coats to protect skin of the forearms and clothing likely to be soiled with blood, saliva, or Change immediately if visibly soiled

- Remove all barriers before leaving the office





2.3 . Masks, Protective Eyewear, Face Shields

- Wear a mask and protective eyewear to protect mucous membranes of the eyes, nose, & mouth
- Change masks between patients, or during treatment if it becomes wet



Masks and Protective Eyewear

- A face shield may substitute for protective eyewear
- Clean protective eyewear with soap & water or if visibly soiled, clean & disinfect between patients



4. GLOVES

- Examination gloves:
  - They must be worn for all dental procedures including extra and intra-oral examination
  - Complete dryness of the hands before gloving
  - a new pair of gloves for each patient
  - Should be changed and disposed of appropriately after completion of procedure
- Over gloves:

  To get supplies out of cabinet

- puncture-resistant Utility gloves:
  - Should be used when cleaning/disinfecting equipment/surfaces







Recommendations for Gloving

- Wear gloves when contact with blood, saliva, and mucous membranes is possible
- Remove gloves after patient care
- Wear a new pair of gloves for each patient
- Complete dryness of the hands before gloving to avoid growth and multiplication of micro organisms under gloves.
- Are not a substitute for hand washing



Recommendations for Gloving

Remove gloves that
are torn, cut or punctured





Do not wash, disinfect
or sterilize gloves for reuse

Personal Protective Elements/Laundry

- Remove all PPE before leaving the work area
- Do not store contaminated clothing or PPE in lockers or offices
- Place contaminated laundry in an appropriately labeled container



(5) Instrument sterilization and Disinfection

Determining what should be sterilized, Disinfected, or discarded

- Critical Instruments
- Semi-critical Instruments
- Non critical Instruments and Devices
- Single use items

Critical Instruments

- Penetrate mucous membranes or contact bone, the bloodstream, or other normally sterile tissues (of the mouth)
- Cleaning followed by heat sterilization is required.
- Single use items must be discarded
- Examples include forceps, scalpel blades, periodontal scalers, and surgical dental burs

- Semi-critical Instruments

- Contact mucous membranes but do not penetrate soft tissue.
- Heat sterilize or high-level disinfect.
- Examples: amalgam condensers, reusable impression trays.

No critical Instruments and Devices

- Contact intact skin
- Clean and disinfect using low to intermediate level disinfectant
- Examples: X-ray heads, facebows

•Single-Use (Disposable) Devices

- Theses items mat be used in critical, semi-critical or non critical areas must be disposed after single use. •

Disposable items include:

- Needles
- Saliva Ejector
- High Volume Suction Tips
- Prophy Cups
- Air-Water Syringe Tips
- Impression Trays

Do not clean & sterilize for reuse



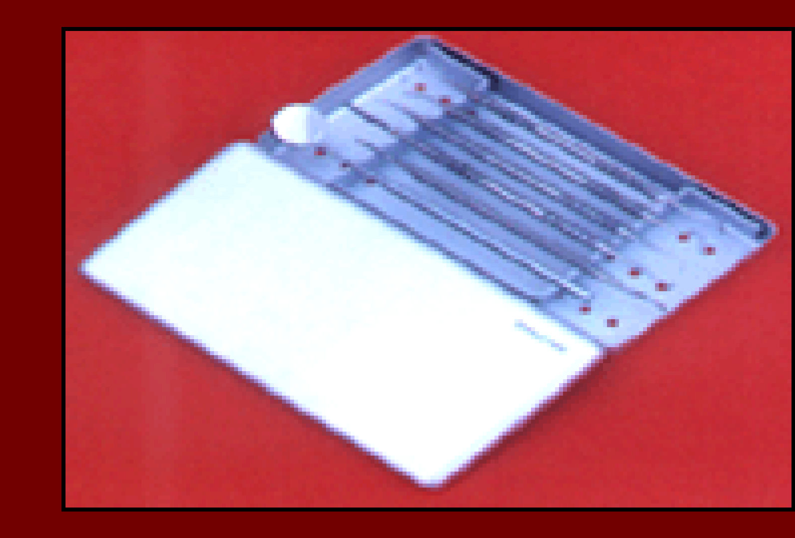
- all **Critical** and **Semi-critical** instruments must be sterilized.
- **Non critical** instrument can be disinfected

Procedure of sterilization;

1. Decontamination of instruments is a multi-step sequential Process.

- Step 1: Transportation
- Step 2: Cleaning and decontamination
- Step 3: Preparation and packaging
- Step 4: Sterilization (or disinfection of equipment not suitable for sterilization)
- Step 5: Storage

- Step 1: Transportation
  Instruments should be carried in a covered container and procedures should be in place to ensure that there is no contact between contaminated and sterilized instruments



- Step 2: Cleaning and decontamination of instruments and equipment:
- All instruments must be cleaned thoroughly to remove visible deposits by using water and detergents or soaps and washing or scrubbing the object.

Instrument may be cleaned in one of three ways:

- Hand scrubbing,
- Ultrasonic
- Instrument washing machines

Instrument Processing
Cleaning

- Wear puncture- and chemical-resistant heavy duty utility gloves for instrument cleaning & decontamination procedures
- Wear a mask, protective eyewear, and long-sleeved protective clothing when splashing/spraying is expected during cleaning
- Head/shoe covers may be required.



Precleaning is important

- This debris can interfere with the sterilization process

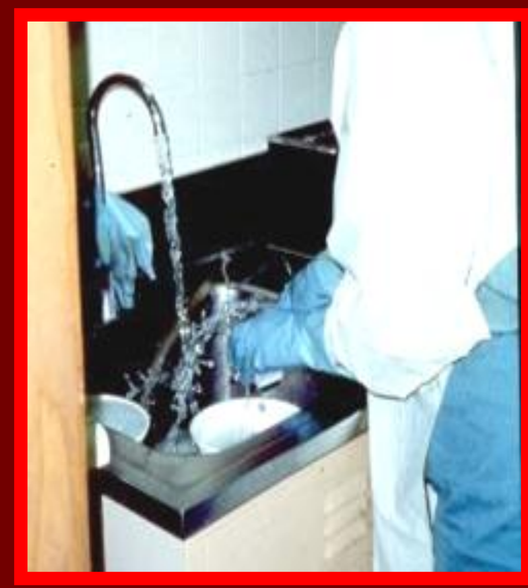


a. Manual Cleaning

- Soak until ready to clean
- If hand scrubbing is unavoidable, use work practice controls (e.g., long handled brush).







b. Ultrasonic cleaner



c. Washer-disinfector

- Automated equipment is preferable to manual hand scrubbing



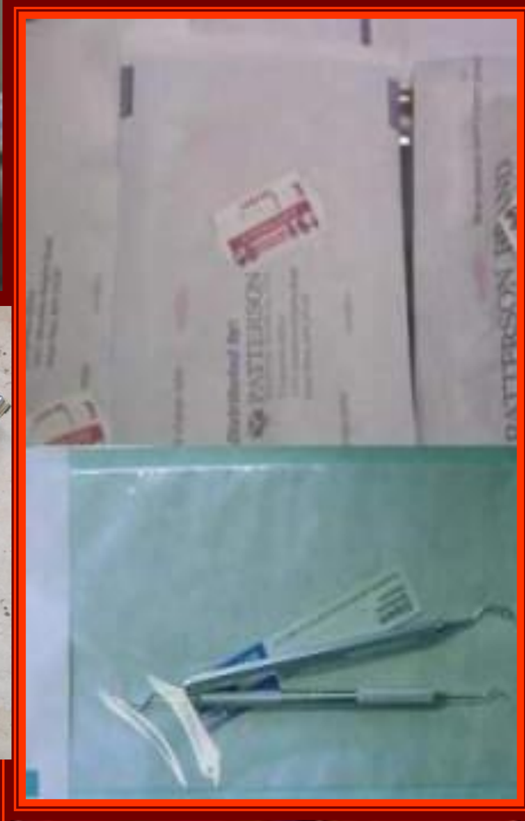


Step 3: Preparation & Packaging

- Before heat sterilization, inspect instruments for cleanliness
- Wrap or place in packages to maintain sterility during storage or placed in containers before heat sterilization











STERILIZATION

- A process that destroys all microbial forms, including bacterial spores.
- All reusable items (critical and semi-critical) instruments that come in contact with the patient's blood, saliva or mucous membranes must be heat-sterilized.

Sterilization

- Can be achieved through the followings:

(I) Physical (heat based) sterilization:

1 - Steam under pressure (autoclaving):

Gravity displacement

Pre-vacuum

2- Chemical vapor sterilization(chemiclave).

3 - Dry heat sterilization.

(II) Chemical sterilization (cold sterilization).

(III) Radiation sterilization.

(I) Physical (heat based) sterilization: 1. Steam under pressure sterilization (autoclaving)









2. Chemiclave



3. Dry heat sterilization





Preparation and Packaging

- Use wrapping compatible with type of sterilization
- unwrapped Critical and Semi-critical instruments must be used **immediately** . (transported in a sterile covered container)
- Do not store critical instruments unwrapped.

Sterilization Monitoring Types of Indicators

- Mechanical
  - Measure time, temperature, pressure
- Chemical
  - Change in color when physical parameter is reached
- Biological (spore tests)
  - Use biological spores to assess the sterilization process directly

Instrument Processing Sterilization Monitoring

- Monitor each load with mechanical indicators
  - Time
  - Temperature
  - Pressure






```
AUTOCLAVE NO
LOAD NO:048
OPERATOR:
O.K.
E25 263°F 03
S24 274°F 28
S23 274°F 28
S22 274°F 28
S21 273°F 27
S20 273°F 28
S19 273°F 27
S18 274°F 28
S17 273°F 29
H16 273°F 27
H12 261°F 20
H08 219°F 04
H04 133°F 00
H00 123°F 00
MN  TEMP  PR
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TIME:01:35:2
DATE:01:30:9

Version:T93N
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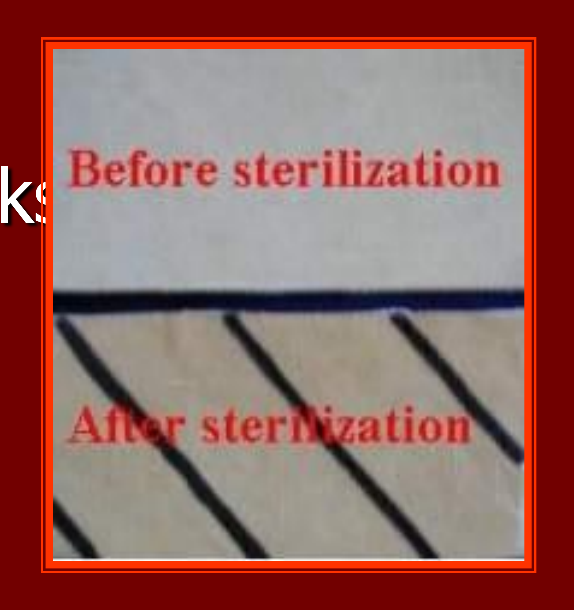
Instrument Processing Sterilization Monitoring

- Use an internal chemical indicator in <u>every</u> package. If the internal indicator is not visible from the outside, then use an external indicator
- Inspect indicator(s) after sterilization & at time of use



Instrument Processing Sterilization Monitoring

- Do not use instrument packs if chemical or mechanical monitoring indicate inadequate processing







Instrument Processing Sterilization Monitoring

- Use biological indicators (spore tests) at least weekly
- Autoclave/chemiclave
  - *Bacillus stearothermophilus*
- Dry heat
  - *Bacillus atrophaeus*

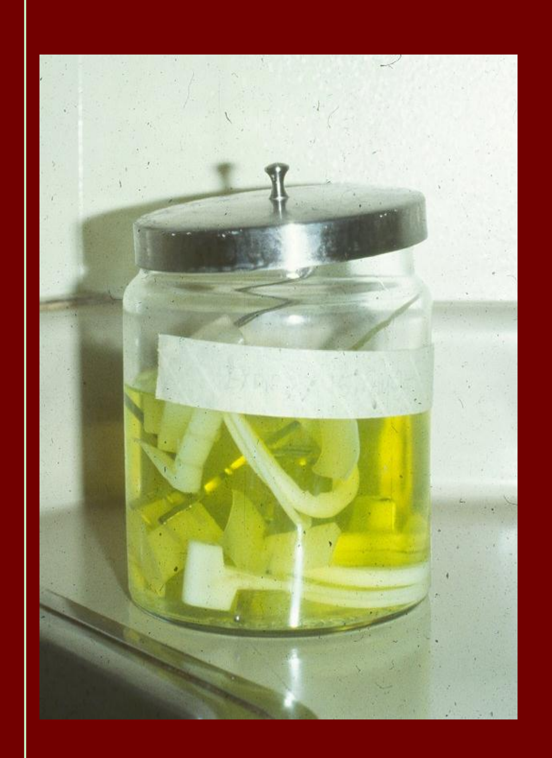




II) Chemical Sterilization

- Only for heat-sensitive semi-critical devices.
- Method: Immersion.
- Examples:

1. **2% to 3.4% Glutraldehyde**
2. **Ethylene oxide.**



III) Radiation sterilization

- Atmospheric pressure cold plasma (APCP) using helium and oxygen was developed.
- A suitable sterilization method for a clinical environment.

- **Disinfection**

A process that eliminates many or all microorganisms except bacterial spores.

- **Methods of Disinfection:**
  - **a. Thermal disinfection: heating to a degree below sterilizing temperature e.g boiling water**
  - **B. Chemical disinfection : Their activity is related to the following factors: concentration, PH, Contact time, temperature.**

Disinfection

High-level disinfection

Intermediate-level disinfection

Low-level disinfection

- High-level disinfection can be expected to destroy all microorganisms, including bacterial spores and tuberclosis, HIV, and HBV.

Examples

1. Glutaraldehydes with phenol,
2. Stabilized hydrogen peroxide 6% or hydrogen peroxide with peracetic acid,
3. Orthopthaldehyde.



Intermediate disinfection A process that is capable of killing M. tuberclosis, HIV, and HBV but not capable to kill bacterial spores.

Examples:

1. Chlorine-based products e.g Chlorine Dioxide, Sodium hypochlorite.
2. Iodophors,
3. Phenolics

Low-level disinfection can kill most bacteria, some viruses, some fungi,

but it cannot be relied on to kill resistant microorganisms (e.g., M. tuberculosis or bacterial spores).

Not for surface contaminated with blood.

- some phenolics, some iodophors, and citric acid.
- They are household level cleaner.

Success is based on:

- Proper preparation,
- Precise dilution,
- Correct application and
- Adequate exposure time.

Step 5: Storage of Sterile Items.

- Store clean items in dry, closed, or covered container.
- Examine wrapped items carefully prior to use.
- When packaging of sterile items is damaged, re-clean, re-wrap, and re-sterilize.
- all packages should be labeled with the date of sterilization.

Dental Hand pieces

- Clean & heat sterilize all handpieces and other intraoral instruments that can be removed from the air and waterlines of the dental unit between patients



Proper packaging assures sterility



The use of liquid germicides (glutaraldehydes) does not guarantee sterilization due to their limited access into the mechanism and the tiny holes found in hand-pieces.

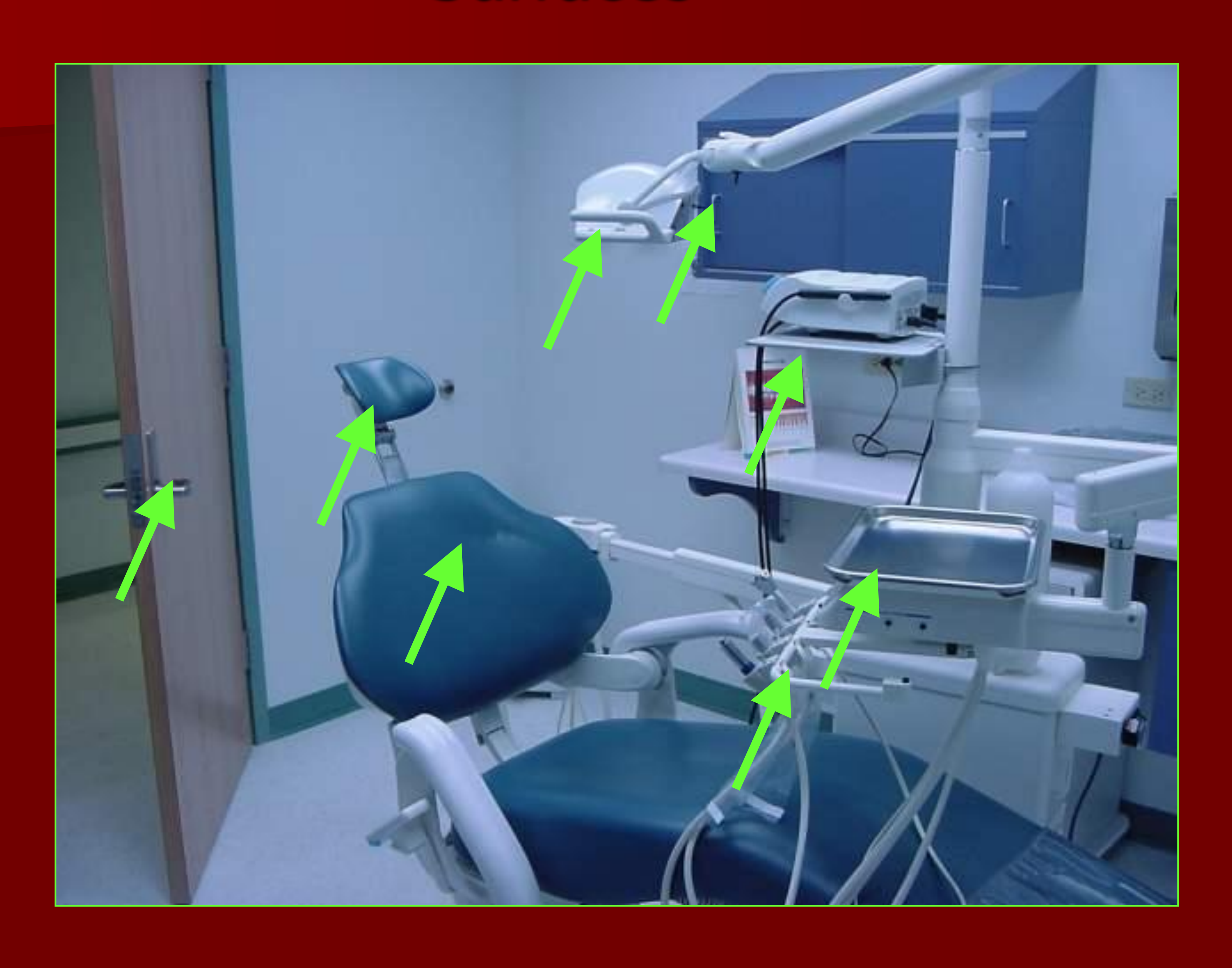
- The four methods of sterilization that are generally accepted in dentistry include steam under pressure, chemical vapor, dry heat sterilization for heat tolerant items and glutraldehyde for heat sensitive items solutions.

- Ethylene oxide gas, ultraviolet light, microwave, and other forms of radiation are effective but have limited use in dentistry at present time

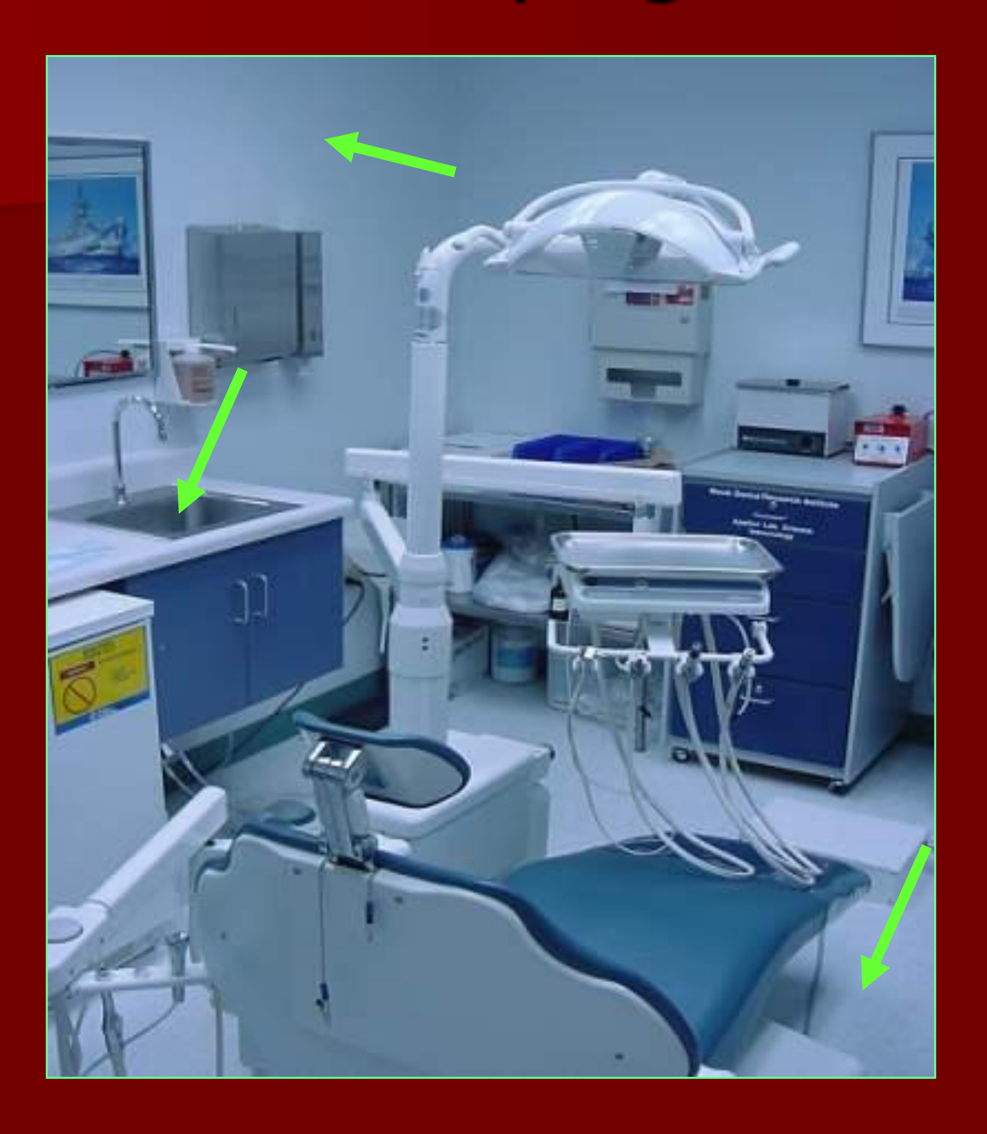
6.Cleaning and disinfection of Environmental surfaces

- **Environmental surfaces are divided into two categories:**
- **Clinical contact and**
- **Housekeeping.**

Treatment area: A. Clinical Contact Surfaces



b. Housekeeping Surfaces



Cleaning Clinical Contact Surfaces

- Use barrier precautions (e.g., heavy-duty utility gloves, masks, protective eyewear) when cleaning and disinfecting environmental surfaces
- Physical removal of microorganisms by cleaning is as important as the disinfection process
- Disinfect using intermediate-level)
- Do not use sterilant/high level disinfectants on environmental surfaces













Environmental IC

- Use surface barriers to protect clinical contact surfaces, especially those that are difficult to clean
- Change barriers between patients





(7) DENTAL LABORATORY

- Microorganisms can leave the dental office and enter the community in a several ways e.g. contaminated impressions, wax rims, articulators.
- Infection can be transferred in lab from case to case
  - By surface contact, handpieces, burs, pumice pans, unwashed hands



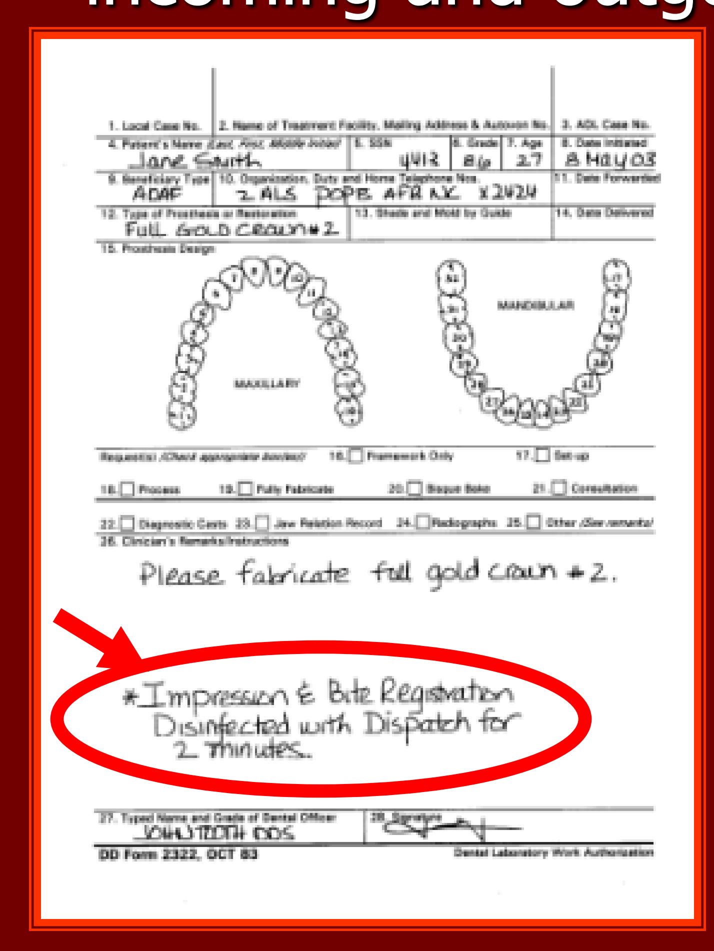
Dental Laboratory Asepsis

Standard precautions.

- Hand hygiene.
- Personal Protective Equipments.
- Heat sterilize any items used intraorally or on contaminated appliances.
- Clean and intermediate-level disinfect all laboratory items before being worked on in the lab.

Dental Laboratory

- Dentists and lab should establish IC protocol for incoming and outgoing cases



1. Local Case No. | 2. Name of Treatment Facility, Mailing Address & Autovon No. | 3. AOL Case No.

4. Patient's Name (Last, First, Middle Initial): Jane Smith | 5. SSN: 4412 | 6. Grade: 86 | 7. Age: 27 | 8. Date Initiated: 8 May 03

9. Beneficiary Type: ADAF | 10. Organization, Duty and Home Telephone Nos.: 2 ALS POPE AFB NC X2424 | 11. Date Forwarded

12. Type of Prosthesis or Restoration: Full Gold Crown #2 | 13. Shade and Mold by Guide | 14. Date Delivered

15. Prosthesis Design

MAXILLARY

MANDIBULAR

Request(s) (Check appropriate box(es)) 16. ☐ Framework Only 17. ☐ Set-up

18. ☐ Process 19. ☐ Fully Fabricate 20. ☐ Bisque Bake 21. ☐ Consultation

22. ☐ Diagnostic Casts 23. ☐ Jaw Relation Record 24. ☐ Radiographs 25. ☐ Other (See remarks)

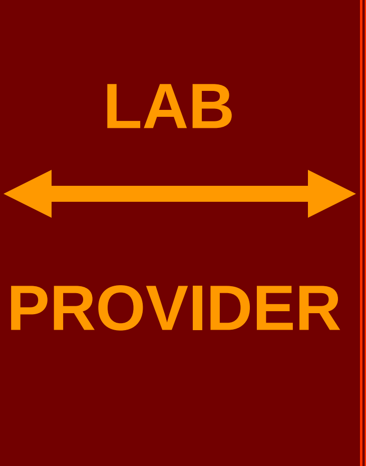
26. Clinician's Remarks/Instructions

Please fabricate full gold crown #2.

*Impression & Bite Registration Disinfected with Dispatch for 2 minutes.

27. Typed Name and Grade of Dental Officer: JOHN TOOTH DDS | 28. Signature

DD Form 2322, OCT 83 | Dental Laboratory Work Authorization





Laboratory items:

- IMPRESSIONS.
- DENTAL CASTS.
- PROSTHESES.
- IMPRESSION TRAYS
- WAX BITES/RIMS,BITE REGISTRATIONS.

IMPRESSIONS

- Microorganisms can be transferred from contaminated impressions to dental casts
  - Oral bacteria can remain viable in set gypsum for up to 7 days





DISINFECTING IMPRESSIONS

- Methods?
  - Spraying,
  - Dipping, immersing

- Spraying technique can be used with impression material with potential for absorption and distortion.

- Immersion technique can be used with impression material have dimensional stability is not significantly affected by immersion technique

Type of disinfectant used ?

High to intermediate level of disinfectant:

- Glutraldehyde 2% (10 minutes soak time :Not suitable for reversible and irreversible hydrocolloid and polyether or hydrophilic addition silicon impression material because of their tendency to absorb water so its better to be sprayed.

- Iodophors(1:213) dilution can be used with **all** types of impression materials **except polyether** due to its reaction with polyether.

- Chlorine compounds fast acting (1:5 dilution of sodium hypochlorite) can be **used with all types** of impression materials. 0r Chlorine Dioxide.

SPRAY TECHNIQUE

- Rinse entire impression/tray under running tap water after removal from oral cavity
- Place impression in bag and liberally spray the entire impression/tray
- Seal bag to create "charged atmosphere"
  - Reduces exposure to vapors and liquid

SPRAY TECHNIQUE

- Remove from bag at end of exposure time; rinse and pour
- Once stone has set, remove cast from impression
- Dispose of impression material and disposable tray (if applicable) in general waste
- Sterilize reusable tray (if applicable)

DIPPING/IMMERSION TECHNIQUE

- Select disinfectant with short exposure time to minimize distortion and deterioration of surface quality of resulting stone cast.

- Follow same procedures as above except fully immerse or dip impression in disinfectant for recommended exposure time.

DENTAL CASTS

- Very difficult to disinfect
- Is preferable to disinfect impression
- If casts must be disinfected:
  - Spray with iodophor or chlorine product, then rinse.

ORALLY SOILED PROSTHESES

- Scrub with brush and antimicrobial soap
- Place in ultrasonic cleaner.
- Place prosthesis in sealable plastic bag containing 1:10 dilution of sodium hypochlorite or iodophors other intermediate- to high-level disinfectant (not glutaraldeyde or phenols) as manufactured recommended contact time.
- Remove and rinse under running tap water, dry.

Prosthetic appliances received from a laboratory

- should be disinfected prior to insertion into the patient's mouth. Using Chlorine 5%,or Iodophor
- Do not exceed manufacturer's recommended contact time on metal components to minimize corrosion. E.g. chrome-cobalt alloy, (10 minutes)
- Remove and rinse under running tap water, dry.

WAX BITES/RIMS, BITE REGISTRATIONS

- Wax bite or rims: Immersion disinfection may cause distortion to some items so use spray disinfection

- Heavy-body bite registration materials
  – Usually not susceptible to distortion and can be disinfected in same manner as an impression of the same material

STERILIZATION

- Heat sterilize all metal and heat-stable instruments that contact oral tissues, contaminated appliances, or potentially contaminated appliances should be heat sterilized after each use
  - Examples: facebow fork, metal impression trays, burs, polishing points, rag wheels, laboratory knives



DISINFECTION

- Prosthodontic items contaminated by handling should be disinfected (by spray or immersion technique based on type of item) after each use
  - Examples: alcohol torch, articulator, mixing spatula, mixing bowl, lab knife, shade guide.

(8.) Dental Radiology

Potential Sources of cross contamination:

- Film packets
- Film holding device
- Tube head
- X-ray cone
- Exposure button
- Head rest and chair adjustments
- Processing area and solutions







- **Oral microorganisms Remain viable on radiographic equipment for at least 48 hours.**
- **Can survive in used developer/fixer for up to 2 weeks.**

Prevention

- Hand hygiene (powder-free gloves)
- Personal protective equipment (PPE)
- Environmental IC:
  1. Surface barriers
  2. Cleaning and disinfection
- Cleaning/disinfection/sterilization of instruments/items



Environmental Infection Control

1. Surface Barriers







2. Cleaning and Disinfection

If contaminated during procedure clean and disinfect

□ Wear PPE until cleaning/disinfection is completed



4. Cleaning and Sterilization

Many items are:

- **single-use disposable (Use once and discard appropriately)**





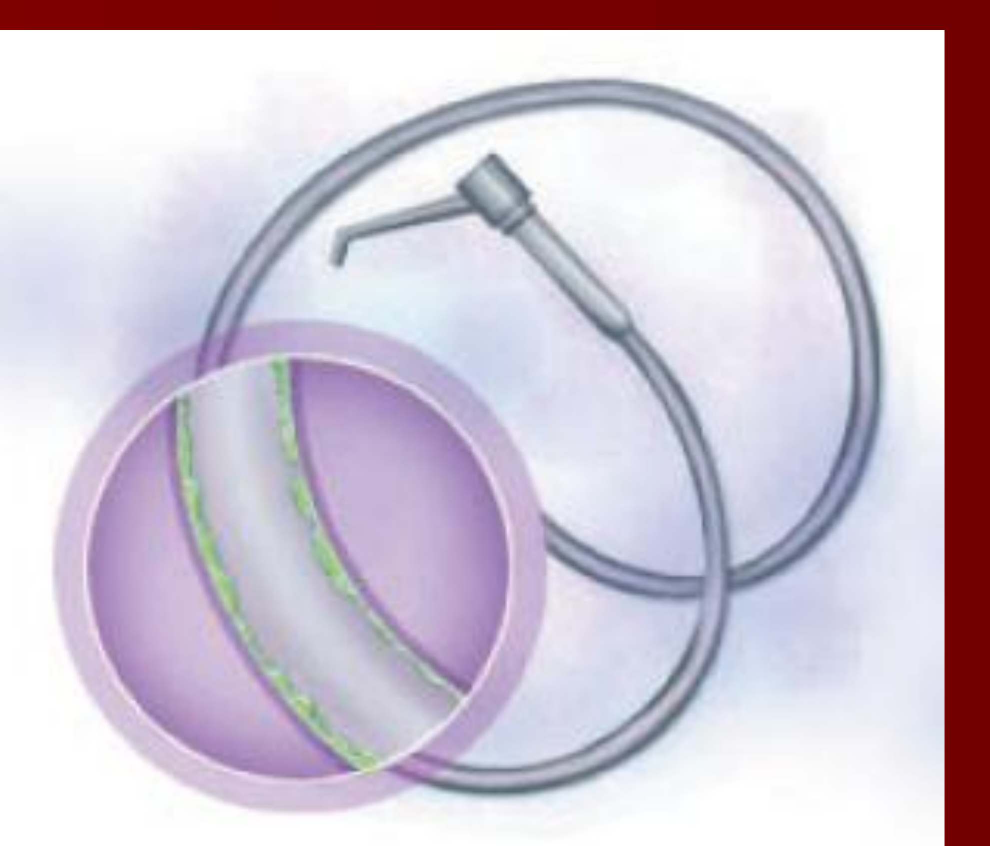
Most reusable items (e.g., film holding and positioning devices) are heat tolerant So Clean, package, and heat sterilize between patients



□ □ If heat-sensitive items clean and immerse in a liquid chemical as a high-level disinfectant.

(9) Dental Unit Waterlines, Biofilm, and Water Quality





Dental Water Quality

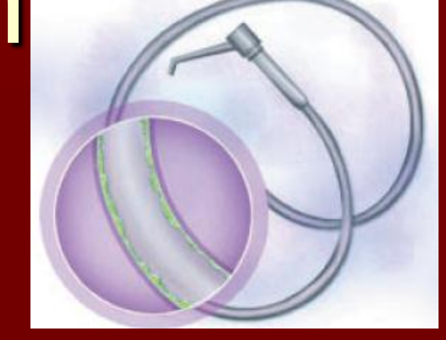
In community water the number of water born bacteria is kept below 500 colony forming units per milliliter.

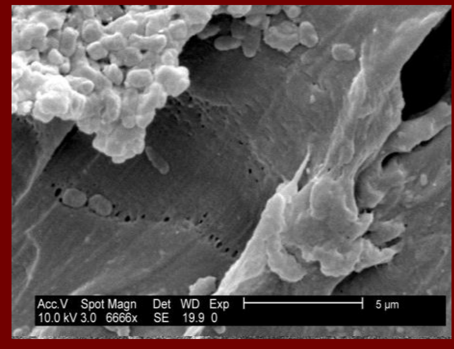


The water from air- water syringes and dental hand pieces frequently has levels that are hundreds or thousands of times greater than permissible in drinking water exceed 1,000,000 CFU/mL

Dental Unit Waterlines and Biofilm

- Microbial biofilms form in small bore tubing of dental units
- Biofilms serve as a microbial reservoir
- Primary source of microorganisms is municipal water supply







Dental Unit Water Quality

- Untreated dental unit waterlines are unlikely to meet drinking water standards







For routine dental treatment, meet regulatory standards for drinking water.*

* <500 CFU/mL of heterotrophic water bacteria

Measures to Improve Dental Unit Water Quality

- Chemical treatment:
  - Strong chemicals weekly
  - Continuous use of low concentration chemicals

1. Regular use of chemical biocides even in Independent reservoir .





Dental Unit Water Quality

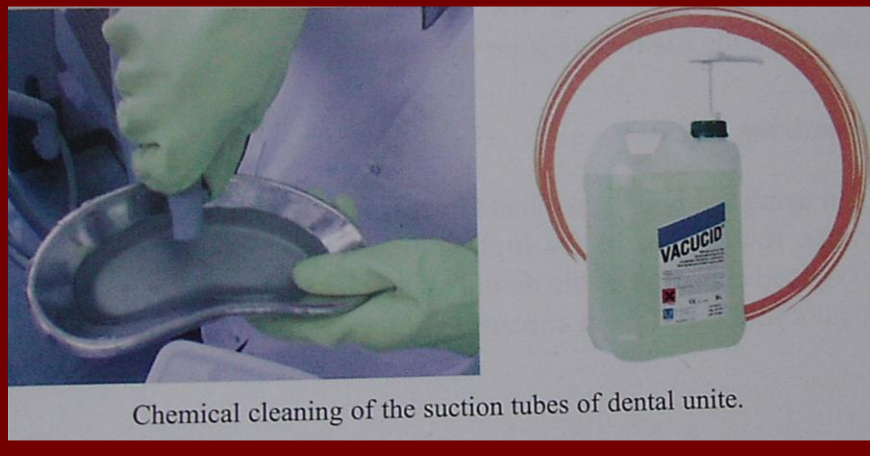
- Microorganisms, blood and saliva from the oral cavity can enter the DUWL during patient Treatment so flushing water lines (20-30 seconds) ,will prevent microbes from one patients to be transmitted to the next.




Backflow and Dental Saliva Ejectors

- Previously suctioned fluids might be retracted into the patient's mouth when a seal is created
- Do not advise patients to close their lips tightly around the tip of the saliva ejector





Chemical cleaning of the suction tubes of dental unite.

10. **Needlestick Injury**

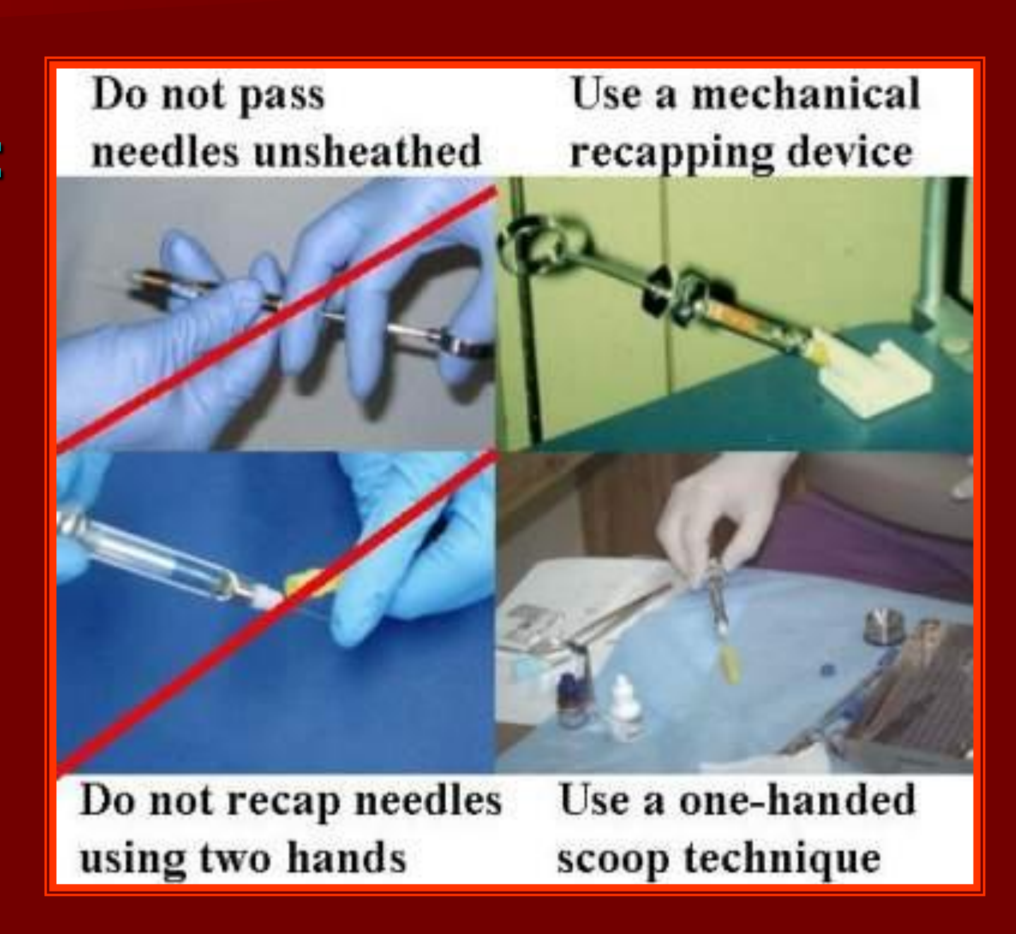
- Sudden exposure that might place health care staff at risk for HBV, HCV, or HIV infection.

Injury occurred while:

- 1. Needles were two hand recapped
- 2. Patients Or staff members made sudden movements
- 3. During collection of the garbage
- 4. During bending the needle prior to final disposal

Needlestick Injury

- **All dental practices should have standard operating procedures** to:
- 1. **Prevent** needlestick injuries
- 2. Manage needlestick injuries,





2. Management of needles stick injuries





(11) Regulated Medical Waste Management

- Sharp items, should be placed in a rigid “safe” container (puncture-resistant container), labeled as containing sharps.
- Non Sharp items placed in sealed, bags to prevent leakage and clearly labeled as infective waste.





Thank you